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American Association of Zoo Keepers, Inc.

The American Association of Zoo Keepers, Inc. exists to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life.

ABOUT THE COVER

This month's cover photo comes to us from Amanda Westerlund of the Pittsburgh Zoo and PPG Aquarium and features an Amur leopard cub (*Panthera pardus orientalis*). The cub was born to the Zoo's 12-year-old Amur leopard, Candy. Candy had a history of miscarriages and a stillbirth, likely caused by a lack of sufficient progesterone development needed to sustain the pregnancy. The Zoo reached out to Dr. Bill Swanson and the team at the Center of Conservation and Research of Endangered Wildlife at the Cincinnati Zoo and Botanical Garden who determined that Candy likely failed to produce enough progesterone to sustain the pregnancy. Candy was placed on progesterone and the pregnancy was successful. It is believed that Candy is the oldest first-time mom of her kind in North America.

Amur leopards are described as critically endangered. There may only be 60-80 of these animals left in the wild and about 220 in zoos around North America, Europe, and Japan.

Articles sent to *Animal Keepers' Forum* will be reviewed by the editorial staff for publication. Articles of a research or technical nature will be submitted to one or more of the zoo professionals who serve as referees for *AKF*. No commitment is made to the author, but an effort will be made to publish articles as soon as possible. Lengthy articles may be separated into monthly installments at the discretion of the Editor. The Editor reserves the right to edit material without consultation unless approval is requested in writing by the author. Materials submitted will not be returned unless accompanied by a stamped, self-addressed, appropriately-sized envelope. Telephone, fax or e-mail contributions of late-breaking news or last-minute insertions are accepted as space allows. Phone (330) 483-1104; FAX (330) 483-1444; e-mail is shane.good@aazk.org. If you have questions about submission guidelines, please contact the Editor. Submission guidelines are also found at: aazk.org/akf-submission-guidelines/.

Deadline for each regular issue is the 3rd of the preceding month. Dedicated issues may have separate deadline dates and will be noted by the Editor.

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ANIMAL KEEPERS' FORUM

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I am proud of the efforts of AAZK to support members at a difficult time and I thank all of you for your continued support for the organization.

"AAZK is a membership association that seeks to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life." This is the mission statement that drives our Association forward. And every aspect of the mission statement has been negatively affected by the COVID-19 pandemic and the associated closures and restrictions for many animal care facilities.

Memberships are down across the board with over 250 individual members being lost since February of this year. These losses are reflective of the difficulties and separations many in the animal care field have faced this year and put a significant strain on AAZK's ability to provide needed support in the short and long-term. And none of these losses speak to the limitations placed on local Chapters and their members as they attempt to adapt to social distancing.

The most effective and anticipated method for advancements and communication is AAZK's Annual Conferences. The Annual Conference brings in hundreds of members, conservation groups, and vendors from around the globe to showcase developments from the past year. The delay in member attendance, partner involvement, and silent auction support in a dynamic city like Los Angeles will be felt for years to come. This year saw the postponement of an annual conference for the first time ever in the 50-year history of the Conference.

Bowling for Rhinos and Trees for You and Me are the signature conservation programs for AAZK. The support shown on the Giving Zoo Days in 2020 have buoyed a difficult year of support for these programs, but even with these efforts, we are unlikely to meet the lofty expectations of BFR and TFYM. And none of this speaks to the incredible support shown by Chapters for conservation groups outside of AAZK. Chapters donated over $840,000 in contributions in 2019 and I am unfortunately confident that we will not approach these levels of support in 2020.

However, this Association prides itself on living up to the mission statement and has been and will continue to maintain high expectations for AAZK. In support of the large number of lost members, a member sponsorship program was enacted earlier this year and job search resources such as example resumes, cover letters, CV's, and interview questions have recently been uploaded to the website to help members seeking to return or enter the field at a difficult time. A reinvigorated AAZK Online is being relaunched starting with resources to assist with successful BFR and Chapter management and plans to grow to provide a wide variety of organizational and professional development courses. The Conservation Committee plans to enact new and exciting opportunities to connect with current affairs of AAZK's Conservation Partners. Despite the financial setbacks, a full slate of Grants will be funded in 2020. And of course, the much anticipated, newly minted 2021 AAZK Annual Conference in Los Angeles is upcoming. I am proud of the efforts of AAZK to support members at a difficult time and I thank all of you for your continued support for the organization.

Regards,

Paul
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Evolution of Psittacines: Neurology, intelligence, and tool usage in parrots

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Parrots are one of the most iconic species of animal on the planet. Large, colorful, talkative, and exotic, they have been symbolic of foreign tropical lands for generations. In addition, many zoological and educational facilities use parrots as animal ambassadors and exhibit icons. There are many questions surrounding these avian marvels, often pertaining to their advanced intelligence. These inquiries can be answered by looking not only at the evolutionary history of parrots but also at the neurobiology throughout their evolution. Parrots evolved complex neurology that allows them to reason, problem solve, learn vocally, use tools, and adapt in ways that only higher order mammals, such as primates or dolphins, were thought to be capable of.

The first glimpse of parrot-like creatures comes from thirty million year old *Archeopteryx* fossils found in France and Germany in the 1860's (E. Britannica, 2018). Few of these fossils have been found since, and the evolution of parrots remained mostly unknown until genetic sequencing became a viable tool for scientists in the 1990's. Mitochondrial DNA has been used to sequence the history of many different species, as the genetic lineage of this specific organelle can usually be traced back to founding members of a species (Christidis, Shaw, & Schodde, 1991). Parrots are no exception to this. When categorized by landmass and genetic similarity, there are three main groups of parrots; Australian, African, and American (Christidis et al., 1991). Australian parrots spread out across that continent and into the South Pacific islands as the major land masses began to drift apart. The few extant African species were found to possess the next most similar DNA evidence, suggesting that this was the next major location of their ancestors' migration. The final group of parrot precursors settled in the Americas before the continents completely split from the major landmass. This group, also referred to as New World parrots, contains the most recent genetic divergence of species and also happens to be the most prolific group, with around one hundred species in South America alone (Miyaki et al., 1998).

Along with a wide and varied distribution, parrots have evolved many differences in size, longevity, appearance, diet, and behavior (Munshi-South & Wilkinson, 2006). One of the most notable traits of some larger parrot species is their lifespan, which is statistically enormous compared to other birds of similar sizes. A Major Mitchell's cockatoo at Brookfield Zoo named Cookie was declared to be the oldest parrot in the world in 2014 at the age of eighty-one, passing away at the age of eighty-three. Compare that to a domestic chicken with an average lifespan of seven to eight years, and the difference is significant. Several factors affect the lifespan of these birds, most notably size, diet, and social tendencies. Larger parrots with varied diets have been found to live longer than those with highly specialized diets, such as fruit, nectar, and seeds (Munshi-South & Wilkinson, 2006). Availability of food and suitability of habitat allows for development of longer lifespans, which in turn sets the stage for developments in other areas, such as intelligence. Macaws and cockatoos, while having beaks that have evolved to crack almost any nut, thrive on a varied diet of grain, fruit, vegetables, and even insects. Highly specialized diets, in contrast, often result in a precarious lifestyle; natural disasters, climate change, and environmental destruction can all wipe out a food source and spell disaster for the survival of a species (Munshi-South & Wilkinson, 2006).

It was long assumed in the field of animal science that the larger the brain, the greater the intelligence. Brain matter is very strenuous for the body to support, so smaller brains were attributed to more primitive workings (Iwaniuk, Dean, & Nelson, 2005). Recent discoveries have debunked that

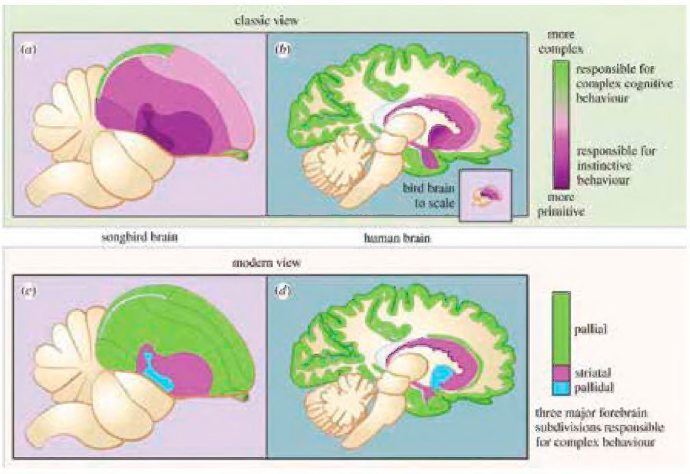
theory, however, with several species of parrots and corvids displaying intelligence equivalent to that of young human children (Byrne & Bates, 2007). Advanced problem solving, critical thinking, and vocal learning have been observed in recent years, as well as a few isolated instances of self-awareness. Such advanced behaviors can be attributed to not only the brain to body size ratio of parrots, but also to the neurological composition of their brains (Emery, 2006). Brain size, and more importantly mass, is paramount to consider when looking at the overall weight of the bird; a larger brain means more difficulty flying, which in turn increases vulnerability to predators. Parrots and corvids (crows and ravens) have been shown to compensate for this by having a much higher neuron density than larger animals such as primates (Emery & Clayton, 2005). Human brains contain a high number of neurons, but they are widely spread out with long connections between them. The neurons in an avian brain are many times denser, with shorter connections, yet almost the same amount of neural cells. This gives these birds a distinct advantage over animals of a similar size (Emery, 2006). With a forebrain relative in size to that of a primate's, these birds also seem to have similar structures that serve the purpose of a mammalian prefrontal cortex (Iwaniuk et al, 2005). Initially believed to have been derived from a separate, more primitive part of the brain, this structure (dubbed the caudolateral nidopallium) holds many of the same functions, including personality expression, social behaviors, and decision making. This gave rise to the theory that several bird species were capable of complex cognitive behaviors stemming from prior experience and planning (Emery & Clayton, 2005).

Testing the intelligence of parrots and corvids has revealed that several species are capable of complex learned behaviors (solving multi-step problems, learning via observation, etc.) previously only seen in primates (Emery, 2006). In addition to these abilities, many avian brains also possess highly developed regions that receive and process sounds. Vocal learning, or the ability to understand, process, and replicate sounds, is critically important in early human development when learning a language or social skills, and was previously thought to be exhibited only by humans and possibly cetaceans (dolphins, whales, etc) (Medina-Garcia et al., 2015). Parrots possess the ability to not only process complex sounds and learn from them, but they have also learned to process different 'languages' (e.g. using human words properly). After gathering and decoding the new language, these birds have demonstrated the ability to use that language to make their thoughts and feelings understood, both in quality and quantity. Like human children, parrots have been known to babble and practice their speech. Seemingly random noises may just be fun to make, and other sounds can get a reaction from caretakers or others close by. A parrot, while having specific sounds and calls to communicate with its own species, can also ask a human for an item and be understood perfectly. This specific trait (grasping numeric and relational concepts) was previously only attributed to hominids, and was never expected to be found in a smaller species, let alone one of avian origin (Jarvis et al., 2005).

Vocal learning was one of the most important discoveries in examining avian intelligence, but the ability to solve problems and use tools were also of great significance. Problem solving to obtain a high-value reward (food) was found in several species of parrots, notably cockatoos, keas, and African greys (Auersperg et al., 2011). Having to unlatch a door, lift levers,

Karten, Harvey J. Vertebrate brains and evolutionary connectomics: on the origins of the mammalian 'neocortex'. *370. Phil. Trans. R. Soc. B.*

The classic view (*a&b*) indicates the long-accepted structure of an avian brain in comparison to a human brain. Birds were thought to possess very little brain matter dedicated to complex, forward-thinking behaviors, and were instead assumed to be creatures of instinct, not intelligence. However, as neurobiology and the understanding of brain regions has progressed, it became clear that avian brains did indeed possess areas akin to our centers of complex thought and personality. The modern view (*c&d*) indicates the current understanding of an avian brain. This image highlights the vast amount of space dedicated to complex thought, sound processing, future planning, personality, and overall 'intelligent' behaviors. These attributes have only recently been verified by brain analysis, indicating that there is still much to learn about the way these animals process and react to their world.



or push buttons to obtain a reward demonstrates the ability to rationalize cause and effect, and parrots were discovered to be especially adept at mastering puzzles after observing a peer do the same action. This ability to learn through observation indicates the ability to plan and draw on past experiences, as well as applying that second-hand knowledge to a new situation (Byrne & Bates, 2007). While quite a few species of parrot were observed to have problem solving capabilities, a select few species have been found to understand and use tools. Goffin's cockatoos and hyacinth macaws have been observed both using objects as tools and creating their own tools to aid in obtaining food, such as using or crafting a stick to reach a nut behind bars. Such actions were previously only attributed to primates and crows. Macaws were also discovered to use different objects to assist in opening/holding nuts, which was another novel tool-use behavior (Borsari & Ottoni, 2005).

Parrots, and birds in general, were historically considered to be less than intelligent. However, evolutionary history and behavioral studies have recently proven that these birds possess many similar neural structures and capabilities equal to that of much larger mammals. Gone are the days of mindless mimicry; instead, it is now understood that these birds are aware of their abilities and use them to influence not only their actions but our own. In addition, advanced behaviors such as problem solving, vocal learning, and tool usage have been attributed to several species, comparable to human abilities. With this information comes greater responsibility for these animals' caretakers. Ensuring that these birds are taken care of physically as well as mentally is extremely important in their well-being and also in furthering the understanding of their capabilities. Having a great capacity for intelligence means the brain must be stimulated, and providing opportunities to forage, build, and destroy things is hugely important to their health. These discoveries have greatly reshaped the understanding not only of the composition and nature of the avian brain, but also the perceived prerequisites for 'intelligence' and what animals are able to achieve these cognitive heights.

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Amur Leopard Cub and Keeper Relationships

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Amur leopards are a critically endangered species primarily due to habitat loss and poaching. In the wild, there are approximately 80 animals living along the southeastern border of Russia/northeast China. In the Species Survival Plan® there are approximately 86 professionally managed Amur leopards. The Association of Zoos and Aquariums' conservation initiative to improve this population status, from critical to vulnerable, is partially based on increasing professionally managed reproduction. Forward-thinking care and managed breeding success are critical objectives to support the future of this species.

At Chicago Zoological Society's Brookfield Zoo we have had a female, named Lisa, since December 2012 and a male, named Kasha, since June 2013. For information on our first 2016 successful breeding introduction with Lisa and Kasha, please refer to the May 2018 Felid TAG Times article, "Adapting Your Introductions to Fit Your Leopards." For our 2018 breeding strategy, we set up numerous "howdy" socialization sessions between the two animals. These soft introductions were arranged when Lisa was displaying both non-estrous and estrous behaviors to lessen the potential of unpredictable behaviors when introductions began. In December 2014 when they were both four-years-old, the physical introductions began taking place. Over the last four years, this pair has produced three cubs, male Temur born on July 22, 2016 and males Jilin and Samson born April 18, 2018.

Based on the critically important need to have managed breeding success, keepers focused on both positive keeper interaction and operant conditioning to provide the leopards with an active life and voluntary, hands-off physical and medical care. Behavioral success would allow the cubs to be more adaptable and self-confident to new situations and would benefit the vitally important

Photo by Jim Schulz @ Chicago Zoological Society

institutional transfers for future breeding recommendations. Keeper interaction with Jilin and Samson began a month earlier than Temur based on Lisa's more relaxed behavior with her second litter of cubs.

Following the birth of Jilin and Samson, one keeper was present daily but briefly near the nest box to offer food to Lisa, refill water and monitor her maternal behavior and care. At five-weeks-old, we introduced a second keeper to the holding area to begin desensitizing the cubs to the presence of multiple staff. For the first few days, both staff members quietly sat in the keeper service area for short periods of time.

Beginning at six-weeks, keepers extended the daily amount of time they were present in the holding area. One keeper separated and fed Lisa and the other keeper entered the enclosure with the cubs to service the area. At this point, we paired established and valuable enrichment items with keepers to associate the cubs with positive keeper interactions. Enrichment items were our primary reward since the cubs were only consuming milk while nursing and they did not yet consume meat. The goal of these sessions were to prepare Lisa and the cubs for husbandry training, socialization, and veterinary care.

At nine-weeks of age, we introduced the Amur Leopard family to small guest tours in an effort to familiarize the cubs with more people and prepare them for access to their outdoor exhibit while visitors were present. Since keeper interaction began when they were younger, they were very comfortable and interested in new enrichment and interaction with people. Additionally, Lisa was very confident around people and was easily guided, or voluntarily took some alone time away from her cubs.

Photo by Jim Schulz @ Chicago Zoological Society

During this time, the cubs became interested in meat products so the keepers began separating them from Lisa up to two times a day for feeding and training. The cubs remained together, but Lisa was in an adjacent holding area with visual contact. These feeding sessions allowed keepers to develop a positive interaction with the cubs. At this time, keepers began training sessions by conditioning a whistle bridging stimulus by pairing it with food. Due to the cubs' comfort with keepers and interest in food, the bridge was established very quickly.

Shortly thereafter, from nine-weeks to four-months old, keepers began training basic husbandry behaviors (target, up, paws, etc.) and started introducing physical items needed for new planned behaviors (crating, weights, etc.). Additionally, keepers began desensitizing the cubs to tactile interactions, both through the mesh and directly, and introduced them to small chutes for hand injections. Keepers took advantage of training during the free-contact time to focus on basic, as well as more complicated behaviors.

When the cubs turned three-months-old, we gave the family group access to their outdoor habitat. In a very short time span, they easily shifted back and forth between the two areas. The cubs were particularly active on habitat showing interest in each other, Lisa, enrichment items, and visitors. In the beginning of shifting and exhibit access, keepers still had the option of entering the area with the cubs when needed. However, that access ended at four-months-old when both cubs became more active and were growing larger. Additionally, at this point in their training, all behaviors had been modified to set up protected-contact training through the holding mesh.

Cub training sessions continued daily with each keeper focused on different behaviors and then transferring them to all keepers once achieved. Behaviors included target, stand up, lie down, sit, open mouth, crating, scale for weights, and hand injections. All the behaviors allowed keepers to get closer views of the cubs' bodies, moving them to new locations when needed, observe/treat any areas under veterinary care, allow them to accept voluntary vaccinations, and get weights on a routine basis.

Our staff is devoted to taking an active role in the Amur leopard Species Survival Plan®. The goal of achieving successful breeding and training of this species motivates us to come up with creative and proactive solutions to ensure that we provide exceptional care. As keepers, we continue to enjoy the success and positive progress that occurs with this critically endangered species.

I want to thank all CZS staff that were involved with our successful Amur leopard breeding program, especially Brookfield Zoo Veterinary Services and all of the large carnivore keepers. Constant motivation and continuous hard work provided positive success for our Amur leopard cubs.

Morphology and Heat Regulation in the Bills of Toucans *(Ramphastidae)* and Hornbills *(Bucerotidae)*

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Toucans (*Ramphastidae*) and hornbills (*Bucerotidae*) are birds with abnormally large bills for their size. Although bill size variation has historically been considered to be a factor of food consumption, it is now suspected that the bill size is not directly correlated to diet, but rather to another purpose: heat regulation.

Typical hornbills and toucans are two bird families whose members are spread throughout four of the seven continents. Ramphastidae are dispersed throughout the Americas. Bucerotidae are found primarily in sub-Saharan Africa and South and Southeast Asia. Beyond this large geographical distance separating the two families, they are also found in varying habitats that are unalike. For instance, the toco toucan, *Ramphastos toco*, is found in savanna and cerrado habitats within northern South America (ADW, 2011). Conversely, the

southern yellow-billed hornbill (*Tockus leucomelas*) is found in the wetlands and grasslands of southern Africa (IUCN, 2016). These are just two representative examples, but together the two families comprise over one hundred species.

As a result of the variety of these animals, the diet of hornbills and toucans is nearly as diverse as the families themselves. Various authors have suggested that this has to do with bill size, though many other explanations have been proposed. Allen's Rule was proposed in 1877 and states that body proportion correlates to the climate in which a particular taxon lives; i.e. animals living in a colder climate will have shorter appendages. This was predated by Bergmann's Rule, which states that larger species are generally found in colder climates (Nudds & Oswald, 2007). Combined, they can be taken to mean that larger taxa are found in colder climates, with the largest individuals found in the warmest parts of their range. Little evidence was available until recently concerning the two rules, and multiple other explanations were proposed in the intervening years (reviewed in Nudds & Oswald, 2007). The suggestion that variation in body parts (in this case, beak size) is due primarily to diet is disproven by comparing the diets of the species in question. Toucans, especially *Ramphastos* (with the largest bills) are primarily frugivorous (ADW, 2011). The diet of hornbills is much more varied across their distribution. Larger hornbills such as the Asian wrinkled hornbill (*Rhabdotorrhinus corrugatus*) are primarily frugivorous, but smaller species like the southern yellow-billed hornbill are primarily insectivorous, yet also consume nuts and seeds. Despite this, most hornbills and toucans have a large bill size-to-body mass ratio.

Many birds have adapted bill sizes based on the diet they consume. For example, the hyacinth macaw (*Anodorhynchus hyacinthinus*) is a large species of bird found in South America, in the Pantanal area of Brazil where several toucans are also found. Their diet is composed primarily of nuts and seeds, and as such their short but sturdy bill enables them to crack open their food. In addition, their bill can be used as an additional appendage to help them navigate their habitat (ADW, 2004). Despite this particular example of bill use in the animal kingdom, birds with similar diets do not necessarily evolve their bills in a similar way. The southern yellow-billed hornbill, of South Africa, includes nuts in its diet, but has a far different bill shape than that of the hyacinth macaw, instead having a similar shape to that of other hornbills as well as toucans. Despite the similarities in diet between these macaws and hornbills, they have very different beak shapes and sizes. However, animals with such diverse diets as hornbills and toucans have very similarly shaped and sized beaks. This evidence rules out the suggestions by some authors that bill and diet are correlated in all species, instead pointing to other uses for the large bill shared by these families (Hughes, 2014). Tattersall, Andrade, and Abe (2009) propose the large bill of toucans could have been selected for an advantage in sexual selection, or defense from predators. Greenberg *et al.* (2012) believed the varying bill size was simply due to the habitat in which these birds are found. Some authors suggest that the large bill size in Ramphastidae, at least, evolved firstly for a dietary advantage. Of the three groups of *Ramphastos* toucans, the smallest variety with channel bills evolved first. Since then, birds with larger bills such as the toco toucan have evolved (Weckstein, 2005). Although the evolutionary factor first leading to an enlarged bill size may have been food, evolution likely continued for another critical purpose, such as thermoregulation (Hughes, 2014).

Nudds and Oswald (2007) published the first paper with verifiable evidence proving Allen's rule. In their study, it was found that exposed (i.e. non-feathered) parts of many birds' bodies are generally larger in correspondence with temperature. The study did not focus on beak sizes, but as the bill is an exposed area on the birds' bodies it still falls under the purview of Allen's rule. The toco toucan, which has the largest bill of all *Ramphastos* toucans, is among the southernmost species among the genus' distribution (Weckstein, 2005). Its large beak is selected for as a method of heat dissipation (van de Ven et al., 2016). Tattersall, Andrade, and Abe (2009) report that the bill of *R. toco* has a large underlying support structure of blood vessels, making the bill a likely thermoregulator for the birds. In addition, the average temperature around the base of the bill was reported to be 2-3°C cooler than the average temperature of the birds' bodies. The heat loss enabled by the bill allows the birds to fly for a continual period before needing to rest, as opposed to other species lacking this adaptation. However, it is possible that the potential for heat dissipation is too great and can potentially have negative effects during the cooler nighttimes in toucans' native range. To prevent this, birds have been shown to bury their bills in their feathers at night, thereby providing the insulation that is necessarily missing to meet the criteria of Allen's rule (Tattersall, Andrade, and Abe, 2009; Nudds and Oswald, 2007).

Hornbills are similar to toucans in that they fill a wide variety of ecological niches within a similarly wide variety of habitats. The bills of the two families are similar in size and result from convergent evolution, which is commonly seen in New World vs. Old World birds (Hughes, 2014). Similarly to toucans, the bills of hornbills are hypothesized to have first been selected for as a necessity for dietary reasons, and then exapted to serve a secondary purpose of heat dissipation due to changing climate. However, the diet of many hornbills is still reliant upon their ability to use their bills as a tool. For example, the southern yellow-billed hornbill is primarily insectivorous and needs a structurally sound bill to forage for invertebrates in termite mounds and underneath tree bark (van de Ven et al., 2016). Several of the Bucerotidae share similar dual capabilities within their bills, though in Ramphastidae such duality is scarcely needed. As a result of this caveat of dietary necessity, the structure within the bills of hornbills and toucans differ. Toucans have a supporting structure of blood vessels near the base of their bill (Tattersall, Andrade, and Abe, 2009) but hornbills lack this (van de Ven et al., 2016). Despite lacking many of the structural components which make the hornbill's bill an effective thermoregulator, it is still able to function as such.

The primary mechanisms which these birds use to regulate their temperature

are vasodilation and vasoconstriction. These mechanisms evolved to cope with the changing climate in the regions in which these birds are found. Both processes require superb ability to control blood flow within the bill, which is why toucans, with their excellent underlying support structure of blood vessels at the base of the bill, are efficient at thermoregulation (Tattersall, Andrade, and Abe, 2009). Hornbill beaks are vascularized, but not to the same extent as toucans. The vascularity of bird bills is likely a plesiomorphic trait in most birds, owing to the fact that in all birds studied to date, a higher presence of blood vessels than previously thought is detected (van de Ven et al., 2016). Even in such distantly related groups as hornbills and toucans, the birds both possess the ability to vasodilate and vasoconstrict. The control the birds have over their blood vessels in their bills allows them to increase or decrease their temperature accordingly with the climate in which they live.

Although toucans and hornbills superficially share the same methods of thermoregulation, there are significant differences between how the two species achieve the same end result. Some hornbills are inefficient at regulating heat through their bills because it composes a smaller percentage of their bodily mass than in toucans (van de Ven et al., 2016). The difference is so significant in some species that Hughes (2014) suggests that some smaller species are unable to thermoregulate at all. Despite their generally smaller bill size, hornbills are more efficient at vasoconstriction than toucans. Toucans require full development of their bill to have the ability to vasoconstrict, and their bill is only fully developed at maturity. During a critical point in which their parents have stopped caring for them but they have not yet fully developed their beaks, toucan chicks are extremely vulnerable to the cold (especially at night) due to their beaks too effectively dissipating heat (Tattersall, Andrade, and Abe, 2009). The disparity in efficiency by toucans and hornbills is due to the need for the latter to use their beaks while foraging (van de Ven et al., 2016). As a result of the lack of beak thermoregulation, hornbills must use other methods to control their temperature.

Although they have evolved systems of thermoregulation within their bills, hornbills and toucans can also make use of other methods. A commonly employed method of thermoregulation by mammals and birds is the act of panting, also known as respiratory heat dissipation. Hornbills and toucans both begin to pant to lower their body temperature, but there are functional differences between the two families. Toucans begin panting at lower temperatures than hornbills. Respiratory heat dissipation is a resource-intensive activity that requires the animal have an adequate source of water. This is likely not a problem for toucans, which are almost exclusively found in the tropical Americas. However, many hornbills are native to arid grasslands throughout Asia and Africa, and as such water is a valuable resource for them. A direct result of this is their aversion to panting except under high temperature (van de Ven et al., 2016).

A feature unique to some hornbills is that many of the species in the family lack under-wing coverts. These coverts act as a second layer of feathers providing insulation in many avian taxa, as well as smoothing down the underlayer and making the birds more aerodynamic overall. This allows hornbills to employ the method of cutaneous evaporative water loss (CEWL) effectively (Hughes, 2014). CEWL is like sweating in humans; water is perspired through the skin and evaporated as a way of cooling the body. In higher temperatures, rates of CEWL are increased dramatically (Wolf and Walsberg, 1995). This method of thermoregulation is used in all birds, but the lack of under-wing coverts in hornbills makes them especially prone to this strategy.

Toucans (*Ramphastidae*) and hornbills (*Bucerotidae*) are two groups of birds which convergently evolved large bills. The bill was first selected for use in foraging, but then exapted the trait of thermoregulation. This is done via vasoconstriction and vasodilation. The processes used to control body temperature respectively are narrowing and dilating blood vessels in the birds' bills. Toucans have a large underlying vascular support structure for their bill, whereas hornbills instead have a more fortified bill. This is because of the hornbills' continual use of their bills for food-gathering. As a result, hornbills are inefficient at heat dissipation through the bill and make use of other methods of thermoregulation such as respiratory heat dissipation and cutaneous evaporative water loss. Despite this, the bills of both toucans and hornbills are vital instruments to the birds' ability to thermoregulate, and general evolutionary trends are to a larger bill size as time passes.

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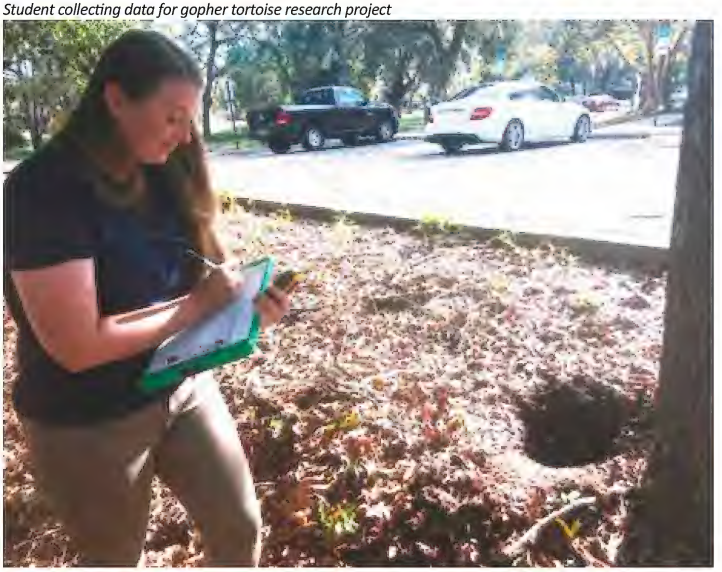
Gopher Tortoise Conservation: Helping students come out of their shells for science

Katy Massey, Conservation Coordinator
Gulf Breeze Zoo
Gulf Breeze, Florida

The confusion between a turtle and a tortoise is a common misconception, sometimes sending tortoises to a watery grave. For example, here are the last words spoken around a gopher tortoise (*Gopherus polyphemus*) before being tossed into a pond during a Snapchat video: "Here's a little note to self, if anyone runs into a turtle. Save it. Don't just leave it on the road. They're so cute. Turtle saving is a hobby!" This video went viral after being shared on a site called Reddit (Jordan, 2015). Unfortunately, this is not an unusual occurrence according to the Florida Fish and Wildlife Conservation Commission.

In 2007, the Florida Fish and Wildlife Service named the eastern gopher tortoise as a Threatened species. This means without intervention the species will likely become endangered in the foreseeable future. Luckily, gopher tortoises in the state of Florida are receiving extra help from the University of West Florida and the Gulf Breeze Zoo.

Student collecting data for gopher tortoise research project



The Zoo recently awarded the 2019 Zoofari Parks Conservation Grant of $5,000 to the local University's Biology Department to help protect this threatened local species. UWF students have been particularly interested in gopher tortoises because they can be found living wild in and around the 1,600-acre campus. "The University of West Florida is very fortunate to have a variety of natural areas, from bayous and wetlands to uplands, including habitat that supports gopher tortoises," said the University's Gopher Tortoise Project Manager Dr. Phil Darby.

Although there is confusion between turtles and tortoises, the biggest threat facing the Florida gopher tortoise is land development. The reptilian resident has to share the sunshine state's year-round warm climate with the ever-increasing number of human residents. Florida's population has grown 15% over the past ten years and is now considered the third most populated state in the country (WPR, 2019). As land development continues to accommodate the 21.3 million residents (USCB, 2018),

Adult gopher tortoise

the gopher tortoise continues to lose important habitat.

The Gulf Breeze Zoo solicited and received grant applications from across the world. When it came time to select a winner, CEO Eric Mogensen decided the best project was in our own backyard.

The Gulf Breeze Zoo solicited and received grant applications from across the world. When it came time to select a winner, CEO Eric Mogensen decided the best project was in our own backyard.

"We wanted to help a local cause, which may otherwise have been overlooked for funding. We believe small things make a big difference, and the gopher tortoise is no exception. This conservation grant isn't just about a donation, it's about making a difference."

Many people don't realize the gopher tortoise is a keystone species; their shared burrows create homes for more than 350 other species, making it essential for the ecosystem (Bryan, 2017). Historically gopher tortoise populations have been threatened by habitat loss, disease, and human conflict in both the pet trade and human consumption (Ankersen, 2003).

The $5,000 grant awarded to the University of West Florida will assist the threatened species by focusing on:

- Gopher tortoise monitoring, using motion-sensitive still cameras to collect data on habitat preferences, demography, and use of burrows by gopher tortoises and other species at the UWF site.
- Surveying and identifying important habitat for the regional gopher tortoise population (public and private).
- Support UWF Biologists to attend FFWCC sanctioned workshops on the ecology and monitoring of gopher tortoises.
- Creating educational materials designed to raise awareness about local tortoise and turtle species to be displayed at the Gulf Breeze Zoo and the UWF campus.

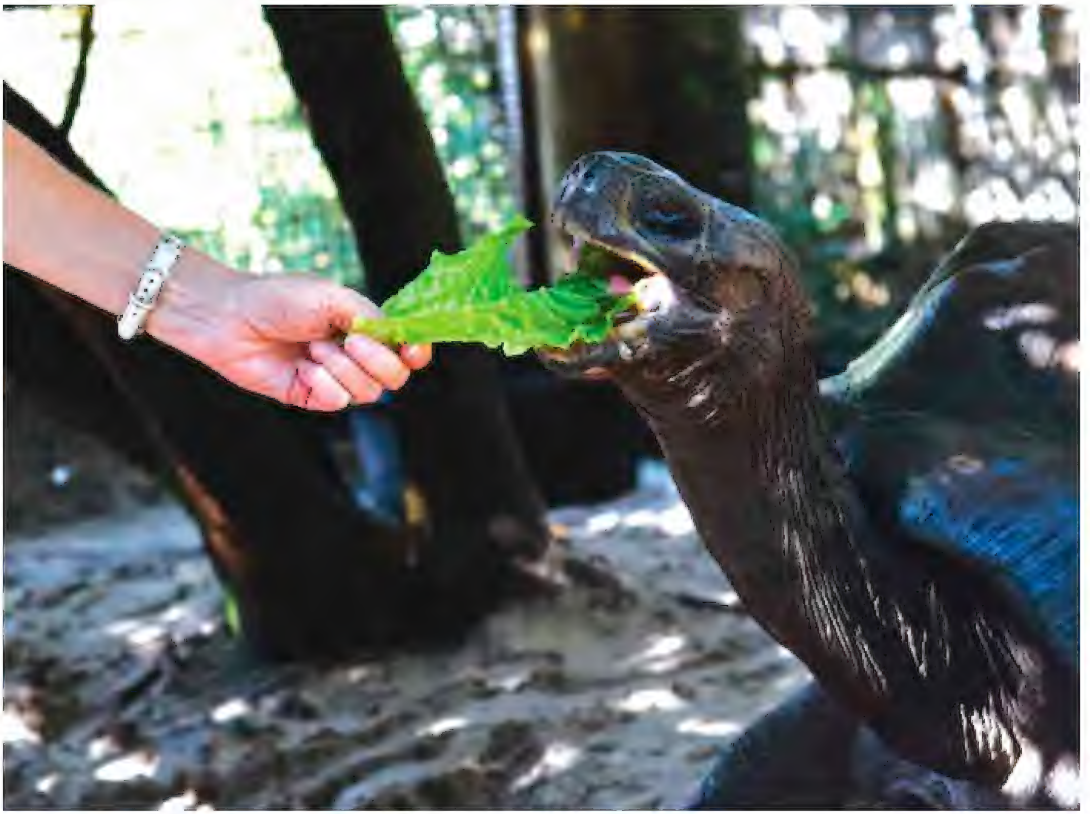
Student involvement in conservation programs teaches life lessons and

encourages students to come out of their shells to learn new things. Project Manager Dr. Phil Darby said "Gopher tortoise burrows and tortoises themselves have been seen routinely near the Biology building," and that the students originally approached him about doing a campus-wide study of gopher tortoises. With undergraduate students lined up to participate in surveying, the conservation grant will provide an opportunity to explore environmental issues and participate in scientific research.

Students will also be given the opportunity to continue their education at the Zoo through a rigorous summer internship program receiving school credit. Educational materials designed through the grant will be displayed

The research team enjoying a group photo at the Gulf Breeze Zoo

Feeding Galapagos tortoises at the Gulf Breeze Zoo



around the Galapagos tortoise exhibit at the Zoo. Creating graphics to teach guests the difference between a turtle and a tortoise is important in a coastal community where tortoises are often mistaken for sea turtles and put in the water. Although individuals have good intentions, tortoises are strictly terrestrial species and cannot swim (Butterly, 2015).

The Zoo "shell-abrated" the UWF conservation grant with the University team by inviting them to the Zoo to meet another threatened species, the Galapagos tortoise. Partnering with the University has given Gulf Breeze Zoo the opportunity to support students who care about local wildlife and can realistically create change. Working with these bright students has given new hope for the future of wildlife conservation and reminds us that there is always something new to learn. In this case: knowledge is power.

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Making Leaps and Bounds in Amphibian Training

Kaitlyn Gabriel, Wild Animal Keeper
Akron Zoological Park

Background

The Akron Zoological Park in Akron, Ohio has 0.0.7 Black and Green Poison Dart Frogs *(Dendrobates auratus)* used for educational programs and meet-and-greets. In April of 2018, keepers devised a plan to station train the frogs with the goal of voluntary participation for kenneling. Before the training began, frogs were shooed with a gloved hand into a display container.

Getting Started

The first step for training was finding a station for the frogs to approach when a clicker sounded in order to receive meals of pinhead crickets and wingless fruit flies (their primary reinforcers). We chose a plastic yellow flower as the station, for several reasons. It is large enough for all seven frogs to go to at the same time, as well as mobile so keepers can move the station into a travel case. Its bright color also serves as a visual cue when placed in the kennel for a training session.

To start, keepers would click a clicker several times and offer food at the flower station. After the frogs learned the connection between the sound of the clicker and the presence of food at the flower, the station was slowly moved to a travel kennel that was established within their larger home. This switch began in July 2018.

Keepers needed to be able to identify individual frogs to accurately track their participation. Above their house hangs a chart highlighting each frog's specific markings. Keepers track frog training on a spreadsheet with each frog identified by letter and the date. Our scoring system for the frogs is on a scale of one to three. A score of one means the frog remained hidden throughout the training session. A score of two means the frog came out of hiding but did not go completely to the station. A score of three means the frog successfully stationed at the flower. Keeping the scoring system simple allowed for all keepers to aid in tracking frog training.

A Change of Plan

For several months, the frogs were fed and kenneled twice a day, every day. A significant issue we encountered was continued motivation to participate. Although four of the frogs stationed more than 60% of the time, the least consistent frog participated only 28% of the time.

We first switched to training only once daily starting in November 2018. After looking more closely at our data, we realized the frogs were more likely to station on fruit fly feeding days. We made a change to our protocol in February 2019 and only asked the frogs to station for fruit flies; when feeding crickets, we would not click the clicker or place the flower station in their travel kennel.

A Change of Scenery

In March of 2019, the frog home enclosure was updated to be bioactive. Up until this point, their home had minimal plants and a few coconut hides that were easy to lift to locate frogs for their daily census. The new bioactive home contained many new hiding locations, so their participation in training became even more important to keeping staff.

Conclusion

Using their preferred food item for training made a big difference! As of September 2019, the least consistent frog comes to the station 61% of the time, with the best frog stationing 85% of the time. Having additional hiding locations did have a small impact on training immediately after the switch; frog "D" had the biggest participation change, dropping 6% the month after the move. After six months of data collection, the best frog still kennels 85% of the time.

In addition to tracking successful stationing, we also kept track of days in view, when the frogs could be censused without having to search for them. The baseline before any changes to their training or home had frogs visible an average of 72% of days tracked. After switching to the bioactive home, frogs were visible for 88% of the training sessions. This improvement is significant for two reasons. First, the frogs are more active in their new habitat, possibly due to more appropriate humidity. Second, the frogs are more likely to participate in kenneling sessions, even with additional hiding spots available.

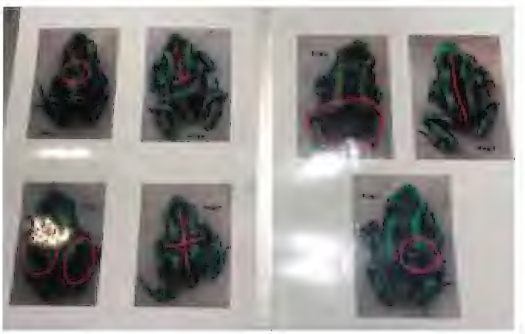
It is not necessary to have all seven frogs for every program. With this training in place, frogs can choose whether to participate in kenneling or not. With animal welfare being at the forefront of all our decisions, allowing animals choice serves to reduce stress and should be included in best practices whenever possible. This training also fits well into our messaging as a zoo to foster empathy with visitors. Educators can still talk about adaptations and ecosystems, but they can also talk about how animals learn, as well as their individual behaviors. Guests are continually impressed when they find out the frogs go into the kennel on their own. They leave the frog encounters with a greater connection than they might have experienced simply seeing them in a display.

continued on next page...

The flower is placed in the travel kennel as a visual cue. A clicker serves as the auditory cue. (Picture taken by Kaitlyn Gabriel)

Frogs receive wingless fruit flies as a primary reinforcer. (Picture taken by Kaitlyn Gabriel)

Frogs go on program in their travel kennel. (Picture taken by Kaitlyn Gabriel)



Frog identification chart, highlighting defining characteristics of each individual. (Picture taken by Kaitlyn Gabriel)

Training Tales Comments: By Jay Pratte

There's some really great stuff in this short Tale. I'll address a few of the training gems embedded, and then discuss the welfare perspective.

First, a brilliant demonstration of how quickly a learned association can develop, even with species that may not normally be considered for a training program. The author describes how the team charged a clicker to associate the sound with food, though in this case the clicker will be a cue, rather than a conditioned reinforcer. Second a great choice of the station: it is distinct as a cue, being bright and obvious, while associated with a specific behavior; naturalistic in appearance so that it is thematically appropriate, while its multi-layered structure provides semi-concealing resting spots for multiple animals; can be removed and cleaned because of the material it is constructed of.

My favorite training take-away is the observations and revising of the training program based on food preferences. Very often we are told that "the tapirs' favorite food is 'x'", or "we always use mealworms for rewards", etc. Observing the behavioral outputs that result from our management practices provides us the tools to best increase our chances for success, and that is what the author and team have done here. Flexibility in the variability and frequency of rewards, based on the animals' responses, is a strong motivational tool.

What I love most about this Tale is the provision of "choice and control" in a species that would normally be handled like many "tractable" species are: by picking up and placing in another location or transport container, or herding/coaxing movement in the desired direction. Many animals, particularly reptiles and amphibians, are likely to "freeze" in the face of perceived danger, which could be construed as "calm and allowing pick-up". It is also not unheard of for learned helplessness to develop if subtle signs of distress are not observed and handling programs revised. This type of simple association training is reward-based and provides the animals control over their environment while minimizing potentially aversive stimuli, allowing the choice to participate or not. Great example of recognition of affective states and improving welfare through training!

Thank you for sharing your Training Tale.

Assessing the Welfare of Ambassador Birds

Helen Dishaw, Curator of Bird Programs, Tracy Aviary

As animal care professionals, most of us have chosen our work because of our deep love for animals and consider the health and welfare of the animals we work alongside to be our highest priority. We know that. We've always known that. It seems like it would go without saying. But it doesn't go without saying and we need to be able to demonstrate, through assessment that our animals are experiencing good welfare. Animal Welfare is a science, and like any science, it lends itself to observation and evidence-based assessment. But why should we go to these lengths?

I'm sure we can all agree, our animals deserve nothing less. But beyond that, in recent years, it has become more critical than ever that the public know how important the welfare of our animals is to us, how diligently we work to ensure that welfare is extremely good, and all the measures we have in place to ensure it is so. Just saying it is so isn't enough, collection of empirical data to substantiate and *prove* our claims is important. Assessment provides us with objective data to demonstrate the good welfare of our animals to detractors and to our guests. And, for AZA accredited facilities, having a formal assessment program is part of AZA's accreditation requirements.

> *1.5. Animal Welfare, Care, and Well-Being*
> *1.5.0. The institution must have a process for assessing animal welfare and wellness.*
>
> *Explanation: This process should be both proactive and reactive, transparent to stakeholders, and include staff or consultants knowledgeable in assessing quality of life for animals showing signs of physical or mental distress or decline. The process should also include a mechanism to identify and evaluate the welfare/wellness impacts of significant life events or changes in the animal's environment as identified by the individual institution. Examples of life events/changes could include construction events, unusual weather events, noise intrusion, change in housing, or changes in animals exhibited with or nearby, etc. Animal welfare/wellness refers to an animal's collective physical and mental states over a period of time, and is measured on a continuum from good to poor.*

Creating a program, and accompanying tools, to formally assess the welfare of ambassador animals seems like a daunting undertaking, until you step back and realize you've been doing it all along – perhaps just informally. In addition, many facilities have already gone through the process of creating welfare assessment tools and are happy to share resources – so you don't need to reinvent the wheel. Tracy Aviary created a program in response to AZA's accreditation requirements, and our *Avian Welfare Program Handbook* and *Welfare Scoring Key* can be found on the AZA website in the Accreditation Resource Center under *Guidelines & Sample Documents, Programs, and Policies* [1]. Using documents already created as a foundation to modify for your own collection can help remove some of the intimidation!

The welfare of the birds under the care of Tracy Aviary is of the utmost priority. We are committed to the physical, social, and behavioral well-being of every individual. In order to be successful in achieving this through all stages of a bird's life, we developed a proactive and solution-based process to address all elements of animal welfare. Our goals are that we will:

- Maximize choice, control, and challenges for our birds.
- Ensure appropriate physical, social, and cognitive complexity.
- Provide comprehensive care that promotes physical, emotional, and social well-being.

So that the birds in our care will:

- Possess the skills to successfully interact with their environments.
- Have opportunities to display natural behaviors.
- Experience well-being tailored to individual needs through all cycles and life stages.

Tracy Aviary utilizes an array of documents and tools that contribute to the overall strength and progress of the Avian Welfare Program. Our welfare program begins with our staff. Welfare of our birds is not only affected by our bird care team, but by all staff – so organization-wide buy-in is critical. All staff at Tracy Aviary are provided training and development so they understand what welfare is and why it is important; the difference between Animal Welfare and Animal Rights; and what measures we undertake at Tracy Aviary to ensure good welfare for our birds. Guests can also have an effect on our birds' welfare, thus we created easy to follow guidelines for visitor and media welfare education so we can get our guests

on-board as well. Our program includes a well-established welfare concerns process, and staff and volunteers know how to report issues they see to our IACUC committee, anonymously if they prefer. We also developed guidelines for exhibit design and construction that maximize welfare of our birds, including a welfare contract any outside contractor working at Tracy Aviary has to sign. And, we developed our all-important Welfare Assessment Tool.

To get started with our welfare assessment tool creation and implementation, we first created a working group. This group determined what observable elements of our birds' lives we agreed contributed to their welfare. We developed objective, observable questions for each of four sections – nutritional state, health, environment, and behavior – and assigned a scoring system to measure these questions. We then completed our first round of assessments and, using the principle of action-feedback-revision, we reviewed the data and re-evaluated perceived issues with our system. For example, we changed our scoring system to reflect issues we thought were more impactful (not all inputs/outputs are equal in impact); we also realized we were "input" heavy, so added corresponding "outputs" for each element. One example of making these changes in practice was recognizing it's not enough to say we are providing enrichment (input), we needed measurable criteria to determine whether that enrichment was being utilized and meeting behavioral goals (output).

There is some debate as to whether ambassador animals should follow the same assessment as exhibit collection, due to the different roles of each. At Tracy Aviary, while we acknowledge that yes, circumstances and roles are different for ambassador birds, we also decided the criteria to determine welfare don't change based on whether the individual in question is an exhibit bird or an ambassador; ergo all our birds are assessed using the same tool, with the same criteria to determine welfare – good to poor. If ambassador birds score lower on elements such as exhibit-size or social housing – that is information for our ambassador team of where improvement can be made; if our exhibit birds score lower on elements of choice and control, similarly those scores inform management decisions on where to make changes and improvements. If we truly want to assess what we are doing, be objective about the welfare of our birds, and identify areas for improvement, we cannot achieve that goal if we change the criteria based on the role of the bird, making allowances for shortcomings because it's an "ambassador," and thus skew the data. For example, if we determine being housed with conspecifics is a significant criterion for good welfare of flocking species – that should apply to all individuals, whether they be ambassadors or exhibit collection, the criteria don't change because the individual is an ambassador bird.

When it comes to assessment of ambassador birds, it bears noting one of the bonuses is that we're so hands-on. Because we work so intimately with our birds, we have a greater ability to catch things before they are an issue. We are continuously informally assessing each individual bird, whether or not we realize it and this makes formal assessment, when we undertake it, easier to complete.

However, this same hands-on, intimate approach with ambassador birds, also leads to a need to be ever more vigilant about our interactions. Scientific evidence has determined control as a primary reinforcer for all living creatures. Thus, the more choice and control over outcomes we can afford our avian ambassadors, the greater their welfare. Empowering birds with this control by employing a behavioral management program focused on most positive, least intrusive teaching/learning methods and providing opportunity to choose voluntary participation in interactions with bird care staff and guests, during daily husbandry and programming, should be of paramount importance. Due to hands-on nature with ambassador birds we potentially have a much larger impact on their ability to control outcomes than exhibit birds. All staff and volunteers handling ambassadors should have a comprehensive understanding of the principles and application of behavioral science, and be trained *and empowered* to maximize choice/control of ambassadors in programming. All ambassador animals should be evaluated continuously on their willingness to continue participating in what is being asked of them. Participation in any programming should have a learned yes/no choice component. Bird choice over participation in programming or any interaction should be respected at all times. All staff/volunteers should be evaluated regularly on their skills at of recognizing, understanding, and respecting each individual bird's preferences and manners of communication. Lack of choice/control should be considered a high negative welfare score and remedied immediately.

Animal Welfare ranges along a continuum from good to poor and can change at any time based on environmental, management, health, psychological, or other factors. At Tracy Aviary, we believe it is therefore incumbent upon us to be ever mindful of our inputs into the animal welfare process, which is what our birds actually experience, and how those inputs influence measurable outputs. When animals depend on us, it is our responsibility to create a situation where they thrive, not just survive, not only at the species level but at the individual level as well – on a day-to-day basis – and to use objective assessment to ensure we truly are providing the best we can.

(1) Sample documents can also be obtained by contacting Helend@tracyaviary.org.

Animal Welfare Assessments and AZA Accreditation: Don't panic, you're already doing it!

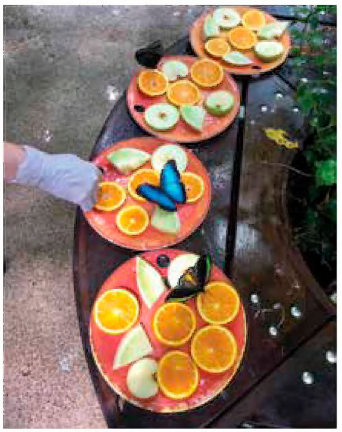
Vikki McCloskey, Curator
Brenda Melton, Associate Director
California Academy of Sciences, Steinhart Aquarium

Accreditation: It's a great impetus for dusting the cobwebs off projects that were put on hold, re-organizing protocols and programs, and an overall assessment of how things have been running for the past five years. This is often accompanied by a feeling of anxiety from all levels of staff. Animal care staff have to make sure their areas are shiny and organized. Operations staff goes into high gear, prioritizing the big fixes and trying to keep on top of the small ones. Registrars politely poke people for the latest census. Managers start feverishly pouring through 119 pages of accreditation standards and dole out assignments. Did we say 119 pages? Yep. Accept the fact that there are never going to be *fewer* pages whenever the Accreditation Commission revises the standards. And that's a good thing. We continually strive to improve conditions for our animal residents, and the more facilities are held accountable, the better we will all perform.

The advantages of a well-designed animal welfare program are numerous. For animal caregivers, the standardized framework makes it easier to get to know new animals, track trends, and set clear expectations and standards for care for everyone. It provides context, and evidence of the observations and care provided over a period of time. For administrators, it provides information that can be used to highlight success and advocate for resources.

One of the biggest hurdles when implementing a new program is staff buy-in. Front-line staff inherently assess the behavior and welfare of animals under their care on a daily basis. Now they are being asked to document, or 'prove' if you will, that they are doing their jobs. This can initially cause some feelings of resentment. Let's face it: nobody goes into animal care for the paperwork. We do it because we consider the animals' welfare our responsibility. We do it for the love of it. We *want* to go to work. Everyone knows that we do everything in our power to keep the animals healthy, happy, and enriched- that's our *job*! But *does* everyone know? When you take a step back and look at the big picture, the majority of the public may not know the intricacies involved in live animal care. Including the latest welfare standards in accreditation not only provides benefits for the staff at your aquarium or zoo, but can also be useful as a tool to educate the general public. Well that's all fine and good, you say, but why does it have to be so complicated? The answer is-it really doesn't.

Steinhart Aquarium is up for accreditation renewal in September,



2019. We thought it may be helpful for other institutions to hear how we incorporated the most recently updated animal welfare standards into our admissions packet.

So how did we package and present the program as an all-encompassing idea? As we are a smaller facility, we do not have a Welfare Department. We designated the chair of our Animal Welfare Committee, the Associate Director of Animal Care, to take the lead in implementing the program. Our focus was on simplicity and clarity in order to craft a program that was straightforward and accessible for all staff to participate in.

AZA members all have access to guidelines and sample documents through the Accreditation Resource Center, including the Animal Welfare Program Template. These resources were a key starting point for us. It took us 12 months to successfully implement our program on all levels. Since we know nobody likes the word 'deadline', we created an accessible roadmap for our team, breaking down steps into digestible bits. Questions that we addressed along the way included: who does the assessments? what is the length of time being evaluated? and with what frequency?

The first step for everyone, both staff and volunteers, was to complete the San Diego Zoo Global Animal Welfare Course as a leveling of baseline welfare information. Following this, primary animal care staff updated their protocols to include select Individual Animal History and Welfare Consideration questions from the Animal Welfare Program Template. The compilation of Natural History questionnaires for all species or like groupings of animals was a collaborative staff effort.

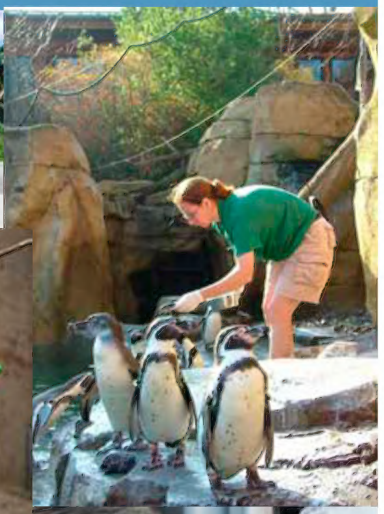
It's rapidly becoming the norm for aquariums to have terrestrial habitats and for zoos to have aquariums. We considered what type of assessment process and documentation was appropriate for our facility, and chose input and output variables for each criterion based on what was appropriate for our resident species. During curatorial rounds with staff, we defined criteria and identified the variables on a practical level while observing animals. Our aquatic staff tend to use a systems approach when assessing welfare, and our terrestrial staff tend to assess based on individual inputs and outputs. We bridged this gap by focusing on natural histories and behavioral goals. To keep it simple (!), we created one assessment form that can be used for all resident taxa, from parrots to jellyfish.

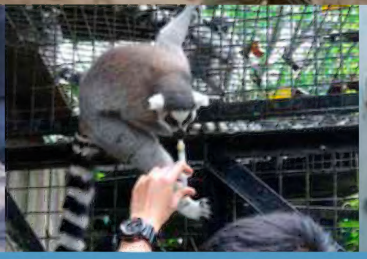
Managers and curators provided the initial testing on all forms and processes, and then brought these to a percentage of front line staff for review and testing. This layered approach solicited endorsement for the program. Staff advocated for the program when they embraced the idea that the standardization of these assessments is not to introduce the importance of welfare, but rather to showcase the efforts being made to continually improve it. When all components were tested, the Animal Welfare Committee reviewed and approved the program.

Ding, ding, ding! Round One. So, are our fish 'happy'? Animal welfare assessments were completed in pairs or trios. We learned our team feels confident that 'happiness' can be translated into observable measurements by clarifying and organizing the key elements of welfare. Questions came up, and we made changes that will help streamline subsequent assessments. Remember, this is a dynamic process that will morph as our profession continues to implement advances in animal care and wellness. The takeaway message? *Don't reinvent the wheel, do what works for your staff, your live animal residents, and your facility.*

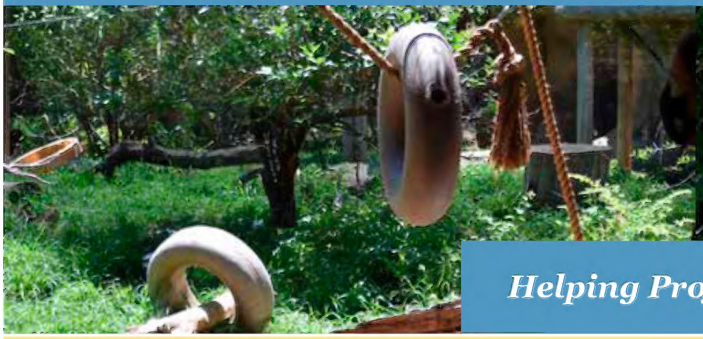
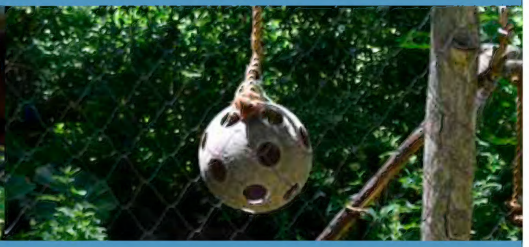
Your life is full of details.






We can help.

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